

# PATENT ABSTRACTS OF JAPAN

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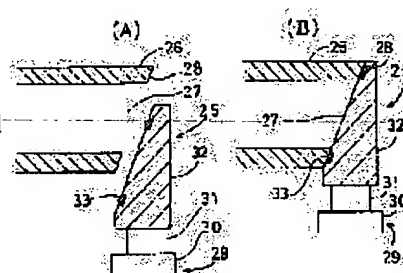
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## (54) GATE VALVE

### (57)Abstract:

PROBLEM TO BE SOLVED: To simplify a structure by opening and closing a gate valve by one actuator, and reduce the cost.

SOLUTION: A valve seat 28 mounted on a peripheral edge of a substrate conveying port 27 of a sealed chamber 26, has the tapered shape, a valve element 32 which can be closely kept into contact with the valve seat 28, can be advanced and retreated in the direction crossing a substrate conveying face by an actuator 30 for opening and closing, and the valve element 32 is advanced by one actuator for opening and closing, to make the conveying port 27 and the valve element 32 stand face to face with each other, and is further advanced, so that the valve element 32 is closely kept into contact with the conveying port 27 to close the conveying port 27.



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3. In the drawings, any words are not translated.

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**DETAILED DESCRIPTION**

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[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention relates to the gate valve prepared in sealed cabins, such as a reaction chamber of semiconductor fabrication machines and equipment.

[0002]

[Description of the Prior Art] Since semiconductor fabrication machines and equipment have two or more sealed cabins, such as a reaction chamber and a cassette room, and this airtight interior of a room must be maintained by a reduced pressure state or the vacua, corresponding to a situation, opening is opened and closed by the gate valve which has airtightness.

[0003] The gate valve prepared in the sealed cabin of semiconductor fabrication machines and equipment 1 and these semiconductor fabrication machines and equipment 1 in drawing 4 and drawing 5 is explained.

[0004] A reaction chamber 2 is established in the aforementioned interior back (\*\*\*\*\*) of semiconductor-fabrication-machines-and-equipment 1, the conveyance mouth 3 which carries out carrying-in taking out of the processed substrate (not shown) is formed in this reaction chamber 2, a valve-seat-13-is-formed in this conveyance mouth 3 periphery, the sealants 14, such as an O ring, are formed in this valve seat 13, and the aforementioned conveyance mouth 3 is opened or blockaded by the gate valve 4.

[0005] The conveyance rooms 5 which are sealed cabins are formed successively by the aforementioned reaction chamber 2, the conveyance mouths 6 and 7 are formed in the aforementioned reaction chamber 2 side of this conveyance room 5 and this reaction chamber 2, and an opposite side, a sealant (not shown) is prepared in this conveyance mouth 6 and seven peripheries, and these conveyance mouths 6 and 7 are opened or blockaded by gate valves 8 and 9.

[0006] The substrate transport device 10 is formed in the aforementioned conveyance room 5.

[0007] The cassette shelves 11 are formed successively at the aforementioned conveyance room 5 front side, the cassette stages 12 are formed successively at this cassette shelf 11 front side, and the cassette transfer machine (not shown) is prepared between the aforementioned cassette shelf 11 and the aforementioned cassette stage 12.

[0008] Since the aforementioned gate valves 4, 8, and 9 are carrying out the same composition as abbreviation, they explain only a gate valve 4 below.

[0009] The aforementioned gate valve 4 has the breaker style 15, and both these breaker styles 15 consist of two actuators, the cylinder 16 for opening and closing which is a direct-acting type actuator, and the cylinder for seals (not shown).

[0010] The aforementioned cylinder 16 for opening and closing is formed at the nose of cam of a rod (not shown) of the aforementioned cylinder for seals mentioned later, the rod 17 of the aforementioned cylinder 16 for opening and closing can be expanded and contracted up and down, and the cover plate 18 which is a valve element is attached in this rod 17 upper limit.

[0011] The aforementioned cylinder for seals is prepared in the conveyance mouth 3 aforementioned lower part, and the rod of the aforementioned cylinder for seals can be perpendicularly expanded and contracted to the aforementioned conveyance mouth 3.

[0012] Piping for an operation is connected to the cylinder 16 for opening and closing and the cylinder for seals which were mentioned above, respectively, therefore two piping is prepared, through this piping, the feeding and discarding of the pressure-flow object are carried out, and it carries out flexible operation.

[0013] The wafer cassette (not shown) loaded with processed substrates, such as a wafer, by the external transport device which is not illustrated is carried in into the aforementioned semiconductor fabrication machines and equipment 1, and it \*\*\*\* to the aforementioned cassette stage 12. The aforementioned wafer cassette is transferred to the aforementioned cassette shelf 11 by the cassette transfer machine which is not illustrated. The wafer in the aforementioned wafer cassette transferred to this cassette shelf 11 is transferred by the aforementioned substrate transport device 10 into the aforementioned reaction chamber 2 through the aforementioned conveyance room 5.

[0014] After the aforementioned substrate transport device 10 leaves, the aforementioned rod 17 is raised in the aforementioned cylinder 16 for opening and closing, and the aforementioned cover plate 18 is made to counter the aforementioned conveyance mouth 3. The aforementioned cover plate 18 makes a rod project in the aforementioned cylinder for seals, where a conveyance mouth is countered, sticks the aforementioned cover plate 18 to the aforementioned valve seat 13, and blockades the aforementioned conveyance mouth 3. Airtightness is acquired by the aforementioned sealant 14.

[0015]

[Problem(s) to be Solved by the Invention] The conventional gate valve \*\* described above the opening-and-closing drive of the

cover plate which is a valve element However, the cylinder for opening and closing, Two actuators of the cylinder for seals are performing, and switching action turns into double \*\* and requires time for opening and closing. While the control for making it operate becomes complicated, structure, the pipe line, etc. become complicated. Furthermore, two or more actuators existed, and especially, since the part space was required for the cylinder for seals in order to operate in the perpendicular direction to a valve seat side, and the number of the gate valves according to the number of conveyance mouths, i.e., the number of breaker styles, was required, faults, such as \*\*\*\*, had cost.

[0016] As this invention is made in view of the above-mentioned actual condition and can be opened and closed with one actuator, it simplifies structure, and it aims at reduction of cost.

[0017]

[Means for Solving the Problem] this invention makes the valve seat prepared in the periphery of the substrate conveyance mouth of a sealed cabin the shape of a taper. The gate valve which enabled the attitude of the valve element which can be stuck to this valve seat in the direction which crosses to a substrate conveyance side with the actuator for opening and closing is started. Moreover, two or more sealed cabins adjoin, and are prepared, and each conveyance mouth of the aforementioned sealed cabin carries out phase confrontation. At least one of the valve seats formed in this conveyance mouth periphery is a taper side. The gate valve which prepares in one the valve element which opens and closes two or more aforementioned conveyance mouths and by which one actuator was formed in this valve element is started, a valve element is advanced with the actuator for opening and closing, a conveyance mouth and a valve element are confronted, and are advanced further, a valve element is stuck to a conveyance mouth, and a conveyance mouth is blockaded.

[0018]

[Embodiments of the Invention] Hereafter, the gestalt of operation of this invention is explained with reference to a drawing.

[0019] The gate valve 25 in the gestalt of operation of this invention is formed in sealed cabins, such as a reaction chamber, like the conventional gate valve 4 mentioned above. The following omits the explanation about semiconductor fabrication machines and equipment, and explains a gate valve 25.

[0020] The conveyance mouth 27 is formed in the sealed cabins 26, such as a reaction chamber, the valve seat 28 of this conveyance mouth 27 periphery serves as a taper side of a bending-forward inclination, and the aforementioned conveyance mouth 27 is opened or blockaded by the aforementioned gate valve 25.

[0021] The breaker style 29 of this gate valve 25 has the cylinder 30 for opening and closing which is one direct-acting type actuator, it is prepared in the conveyance mouth 27 aforementioned lower part, the cover plate 32 which is a valve element is attached at rod 31 nose of cam of the aforementioned cylinder 30 for opening and closing, and this cover plate 32 goes up and down this cylinder 30 for opening and closing in the perpendicular direction (the aforementioned valve seat 28 and abbreviation parallel) to a substrate conveyance side in the aforementioned cylinder 30 for opening and closing.

[0022] This cover plate 32 inclines in the direction in which the upper limit of this cover plate 32 deserts the aforementioned valve seat 28, and is jointed with the aforementioned valve seat 28, and the sealant 33 is formed in the aforementioned valve seat 28 of the aforementioned cover plate 32, and the corresponding portion.

[0023] In the state of opening of the aforementioned conveyance mouth 27, the rod 31 of the aforementioned cylinder 30 for opening and closing is descending, and the aforementioned cover plate 32 is located under the aforementioned conveyance mouth 27.

[0024] When it blockades the aforementioned conveyance mouth 27, the rod 31 of the aforementioned cylinder 30 for opening and closing is elongated, the aforementioned cover plate 32 is raised, and the aforementioned cover plate 32 is made to contact the aforementioned conveyance mouth 27. Furthermore, the aforementioned cylinder 30 for opening and closing is expanded, and while the taper side of the aforementioned valve seat 28 and the taper side of the aforementioned cover plate 32 joint, the aforementioned valve seat 28 and the aforementioned cover plate 32 are powerfully pushed by both wedge effect.

[0025] It \*\*, and the aforementioned conveyance mouth 27 is blockaded with the aforementioned cover plate 32, and airtightness is acquired by the aforementioned sealant 33.

[0026] Drawing 3 shows the gestalt of other operations of this invention.

[0027] The conveyance mouths 40 and 41 prepared in two adjoining sealed cabins 38 and 39 carry out phase confrontation, and the valve seats 36 and 37 which are the taper sides of a bending-forward inclination are formed in the periphery of these conveyance mouths 40 and 41. The breaker style 43 common to two cover plates 44 and 45 is formed, and the gate valve 42 which blockades the aforementioned conveyance mouths 40 and 41 performs simultaneously opening of the aforementioned conveyance mouths 40 and 41, and lock out.

[0028] The aforementioned breaker style 43 has the cylinder 47 for opening and closing, the plate support block 49 is attached in rod 48 upper limit of this cylinder 47 for opening and closing, and the cover plates 44 and 45 are attached symmetrically with these plate support block 49 ends. This cover plate 44 and 45 upper limits incline in the aforementioned valve seats 36 and 37 and the direction in which it deserts, and the aforementioned valve seats 36 and 37 and adhesion are possible for these cover plates 44 and 45.

[0029] The rod 48 of the aforementioned cylinder 47 for opening and closing is expanded, the aforementioned cover plates 44 and 45 are raised, and the aforementioned conveyance mouths 40 and 41 are airtightly blockaded like the gestalt of the operation mentioned above.

[0030] Since [ which was mentioned above ] the breaker style of a gate valve is operating only in the cylinder for opening and closing with the gestalt of two operations, the control circuit which drives this cylinder for opening and closing, the pipe line connected to the aforementioned cylinder for opening and closing are good in one cylinder for opening and closing, and does not

have a mechanism with a bird clapper as it is complicated. Moreover, the space in which a gate valve is prepared is also small, and ends, and cost reduces it. Moreover, since opening of two conveyance mouths and lock out can be simultaneously performed in one cylinder in the gestalt of other operations, reduction of cost can be aimed at further.

[0031] In addition, although the cover plate 44 which are a valve seat 36 and a valve element and a valve seat 37, and cover plate 45 both sides considered as the taper side with the gestalt of operation shown by drawing 3, as for either of the combination of a valve seat 36, the cover plate 44 or a valve seat 37, and the cover plate 45, it is good not to be a taper side. Moreover, although the valve element which a gate valve 42 has was made into two of the cover plates 44 and 45, it is good also as three or more according to the number of sealed cabins. Furthermore, the position in which the cylinder for opening and closing is prepared is not restricted to a conveyance mouth lower part again, but you may be the upper part or the side and the flexible direction of an opening-and-closing cylinder may incline to a substrate conveyance side further.

[0032]

[Effect of the Invention] As stated above, in order that a gate valve may perform opening of a conveyance mouth, and a lock out operation only with one actuator for opening and closing, according to this invention, control circuits, the pipe lines, etc. accompanying an actuator decrease in number, the space in which there is not that a mechanism is complicated with a bird clapper, and a gate valve is prepared is small, and ends, and the effect which was [ decrease / cost ] excellent is demonstrated.

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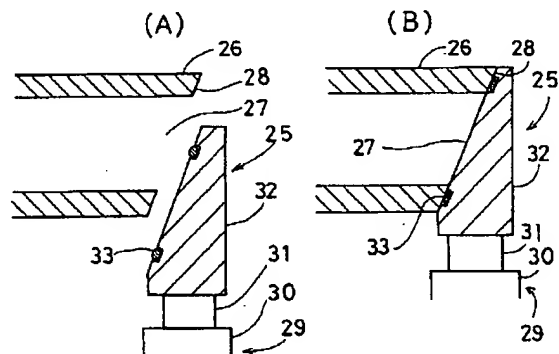
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(54) 【発明の名称】 ゲートバルブ

(57) 【要約】

【課題】 1つのアクチュエータで開閉が行える用にして構造を簡略化しコストの低減を図る。

【解決手段】 気密室26の基板搬送口27の周縁に設けられる弁座28をテーパ状とし、該弁座に密着可能な弁体32を開閉用アクチュエータ30により基板搬送面に対し交差する方向に進退可能とし、1つの開閉用アクチュエータにより前記弁体を前進させ、前記搬送口と前記弁体とを対峙させ、更に前進させ前記搬送口に前記弁体を密着させて前記搬送口を閉塞する。



## 【特許請求の範囲】

【請求項1】 気密室の基板搬送口の周縁に設けられる弁座をテーパ状とし、該弁座に密着可能な弁体を開閉用アクチュエータにより基板搬送面に対し交差する方向に進退可能としたことを特徴とするゲートバルブ。

【請求項2】 複数の気密室が隣接して設けられ、前記気密室の各搬送口が相対峙し、該搬送口周縁に形成される弁座の少なくとも1つがテーパ面であって、前記複数の搬送口を開閉する弁体を一体に設け、該弁体に1つのアクチュエータが設けられた請求項1のゲートバルブ。

## 【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、半導体製造装置の反応室等気密室に設けられるゲートバルブに関するものである。

【0002】

【従来の技術】半導体製造装置は反応室、カセット室等気密室を複数有しており、該気密室内は状況に応じて、例えば減圧状態或は真空状態等に維持されなければならないので、開口部は気密性を有するゲートバルブによって開閉される。

【0003】図4、図5に於いて半導体製造装置1及び該半導体製造装置1の気密室に設けられるゲートバルブについて説明する。

【0004】前記半導体製造装置1内部後方（図中左）には反応室2が設けられ、該反応室2には被処理基板（図示せず）を搬入搬出する搬送口3が形成されており、該搬送口3周縁には弁座13が形成され、該弁座13にはリング等シール材14が設けられ、前記搬送口3はゲートバルブ4により開放或は閉塞される様になっている。

【0005】前記反応室2には気密室である搬送室5が連設され、該搬送室5の前記反応室2側及び該反応室2と反対側には搬送口6、7が形成され、該搬送口6、7周縁にはシール材（図示せず）が設けられ、該搬送口6、7はゲートバルブ8、9により開放或は閉塞される様になっている。

【0006】前記搬送室5内には基板搬送装置10が設けられている。

【0007】前記搬送室5前方側にはカセット棚11が連設され、該カセット棚11前方側にはカセットステージ12が連設され、前記カセット棚11と前記カセットステージ12との間にはカセット移載機（図示せず）が設けられている。

【0008】前記ゲートバルブ4、8、9は略同様の構成をしているので以下ゲートバルブ4についてのみ説明する。

【0009】前記ゲートバルブ4は開閉機構15を有しており、該開閉機構15は共に直動型のアクチュエータである開閉用シリンダ16及びシール用シリンダ（図示

せず）の2つのアクチュエータから構成される。

【0010】前記開閉用シリンダ16は後述する前記シール用シリンダのロッド（図示せず）先端に設けられ、前記開閉用シリンダ16のロッド17は上下に伸縮可能であり、該ロッド17上端には弁体である遮蔽プレート18が取付けられている。

【0011】前記シール用シリンダは前記搬送口3下方に設けられ、前記シール用シリンダのロッドは前記搬送口3に対して垂直方向に伸縮可能となっている。

【0012】上述した開閉用シリンダ16及びシール用シリンダにはそれぞれ作動用配管が接続され、従って2系統の配管が設けられ、該配管を介して圧力流体が給排され、伸縮動作する様になっている。

【0013】図示しない外部搬送装置によりウェーハ等被処理基板の装填されたウェーハカセット（図示せず）を前記半導体製造装置1内へ搬入し、前記カセットステージ12へ乗載する。図示しないカセット移載機により前記ウェーハカセットを前記カセット棚11へ移載する。該カセット棚11へ移載された前記ウェーハカセット内のウェーハは前記基板搬送装置10により前記搬送室5を介して前記反応室2内へ移載される。

【0014】前記基板搬送装置10が退去した後、前記開閉用シリンダ16により前記ロッド17を上昇させて前記遮蔽プレート18を前記搬送口3に対向させる。前記遮蔽プレート18が搬送口3に対向した状態で前記シール用シリンダによりロッドを突出させ、前記遮蔽プレート18を前記弁座13に密着させ、前記搬送口3を閉塞する。気密性は前記シール材14により得られる。

【0015】

【発明が解決しようとする課題】然し乍ら上記した従来のゲートバルブは弁体である遮蔽プレートの開閉駆動を開閉用シリンダ、シール用シリンダの2つのアクチュエータにより行っており、開閉動作は2動作となり開閉に時間が掛かり、動作させる為の制御が複雑になると共に構造及び配管系等が複雑となり、更にアクチュエータが複数存在し、特にシール用シリンダは弁座面に対して垂直な方向に動作する為その分スペースが必要であり、又搬送口の数に応じたゲートバルブの数即ち開閉機構の数が必要である為コストが嵩む等の不具合があった。

【0016】本発明は上記実情に鑑みなしたものであり、1つのアクチュエータで開閉が行える様にして構造を簡略化しコストの低減を図るものである。

【0017】

【課題を解決するための手段】本発明は、気密室の基板搬送口の周縁に設けられる弁座をテーパ状とし、該弁座に密着可能な弁体を開閉用アクチュエータにより基板搬送面に対し交差する方向に進退可能としたゲートバルブに係り、又複数の気密室が隣接して設けられ、前記気密室の各搬送口が相対峙し、該搬送口周縁に形成される弁座の少なくとも1つがテーパ面であって、前記複数の搬

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送口を開閉する弁体を一体に設け、該弁体に1つのアクチュエータが設けられたゲートバルブに係るものであり、開閉用アクチュエータにより弁体を前進させ、搬送口と弁体とを対峙させ、更に前進させ搬送口と弁体を密着させて搬送口を閉塞する。

【0018】

【発明の実施の形態】以下、本発明の実施の形態について図面を参照して説明する。

【0019】本発明の実施の形態に於けるゲートバルブ25は前述した従来のゲートバルブ4と同様反応室等気密室に設けられるものである。以下は半導体製造装置についての説明を省略し、ゲートバルブ25について説明する。

【0020】反応室等気密室26には搬送口27が形成され、該搬送口27周縁の弁座28は前倒傾斜のテーパ面となっており、前記搬送口27は前記ゲートバルブ25により開放或は閉塞される様になっている。

【0021】該ゲートバルブ25の開閉機構29は1つの直動型アクチュエータである開閉用シリンダ30を有し、該開閉用シリンダ30は前記搬送口27下方に設けられ、前記開閉用シリンダ30のロッド31先端に弁体である遮蔽プレート32が取付けられ、該遮蔽プレート32は前記開閉用シリンダ30によって基板搬送面に対して垂直な方向（前記弁座28と略平行）に昇降される。

【0022】該遮蔽プレート32は、該遮蔽プレート32の上端が前記弁座28から離反する方向に傾斜し、前記弁座28と契合する様になっており、前記遮蔽プレート32の前記弁座28と対応する部分にはシール材33が設けられている。

【0023】前記搬送口27の開閉状態では、前記開閉用シリンダ30のロッド31は降下しており、前記遮蔽プレート32は前記搬送口27の下方に位置している。

【0024】前記搬送口27を閉塞する場合には、前記開閉用シリンダ30のロッド31を伸長し、前記遮蔽プレート32を上昇させ前記搬送口27に前記遮蔽プレート32を当接させる。更に前記開閉用シリンダ30を伸長させ、前記弁座28のテーパ面と前記遮蔽プレート32のテーパ面とが契合すると共に両者の楔効果により、前記弁座28と前記遮蔽プレート32とは強力に押しつけられる。

【0025】而して、前記搬送口27は前記遮蔽プレート32により閉塞され、前記シール材33により気密性が得られる。

【0026】図3は本発明の他の実施の形態を示している。

【0027】隣接する2つの気密室38、39に設けられる搬送口40、41は相対峙し、該搬送口40、41の周縁には前倒傾斜のテーパ面である弁座36、37が形成されている。前記搬送口40、41を閉塞するゲ

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ートバルブ42は2つの遮蔽プレート44、45に共通の開閉機構43が設けられたものであり、前記搬送口40、41の開放、閉塞を同時に行うものである。

【0028】前記開閉機構43は開閉用シリンダ47を有し、該開閉用シリンダ47のロッド48上端にはプレート支持ブロック49が取付けられ、該プレート支持ブロック49両端に対称に遮蔽プレート44、45が取付けられている。該遮蔽プレート44、45は該遮蔽プレート44、45上端が前記弁座36、37と離反する方向に傾斜し前記弁座36、37と密着可能となっている。

【0029】前記開閉用シリンダ47のロッド48を伸長させて、前記遮蔽プレート44、45を上昇させ、前述した実施の形態同様に前記搬送口40、41を気密に閉塞する。

【0030】上述した2つの実施の形態ではゲートバルブの開閉機構は開閉用シリンダのみで作動している為、該開閉用シリンダを駆動する制御回路、前記開閉用シリンダに接続される配管系等は開閉用シリンダ1つ分ではなく、機構が複雑となることはない。又、ゲートバルブを設けるスペースも小さくてすみコストが低減する。又、他の実施の形態に於いては1つのシリンダで2つの搬送口の開放、閉塞を同時に行うことができるので、更にコストの低減を図ることができる。

【0031】尚、図3で示した実施の形態では弁座36、弁体である遮蔽プレート44及び弁座37、遮蔽プレート45双方ともテーパ面としたが、弁座36、遮蔽プレート44或は弁座37、遮蔽プレート45の組合わせのいずれかはテーパ面でなくともよい。又、ゲートバルブ42が有する弁体は遮蔽プレート44、45の2つとしたが、気密室の数に応じて3以上としてもよい。更に又、開閉用シリンダを設ける位置は搬送口下方に限られず、上方或は側方であってもよく、更に開閉シリンダの伸縮方向は基板搬送面に対して傾斜していてもよい。

【0032】

【発明の効果】以上述べた如く本発明によれば、ゲートバルブは1つの開閉用アクチュエータのみで搬送口の開放、閉塞作動を行う為、アクチュエータに伴う制御回路、配管系等が減少し、機構が複雑となることなくゲートバルブを設けるスペースが小さくてすみコストが低減する等の優れた効果を発揮する。

【図面の簡単な説明】

【図1】本発明の実施の形態を示す斜視図である。

【図2】(A)(B)は同前実施の形態の作動説明図である。

【図3】本発明の他の実施の形態の作動説明図である。

【図4】半導体製造装置の概略説明図である。

【図5】従来例の作動説明図である。

【符号の説明】

25 ゲートバルブ

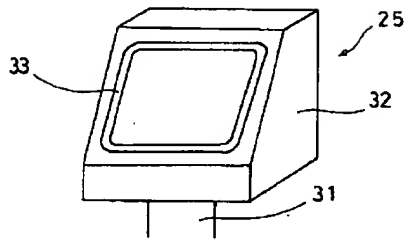
(4)

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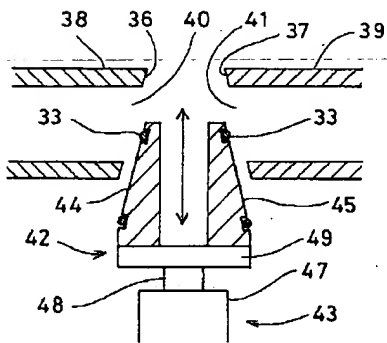
26 気密室  
27 搬送口  
28 弁座  
29 開閉機構

5

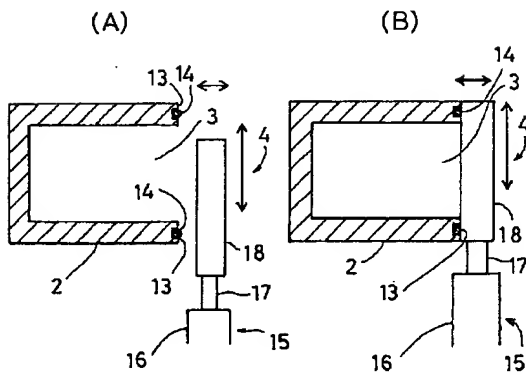
【図1】



【図3】



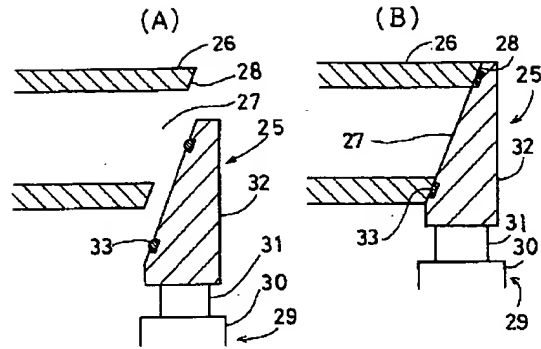
【図5】



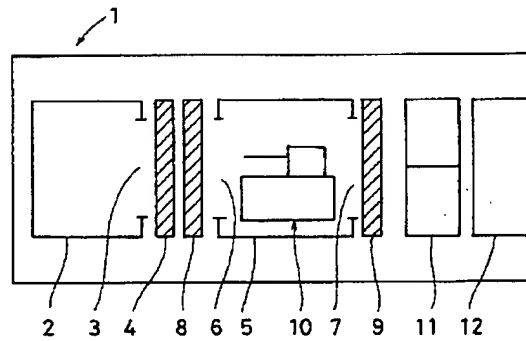
30 開閉用シリンダ  
31 ロッド  
32 遮蔽プレート  
33 シール材

6

【図2】



【図4】





\* NOTICES \*

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1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

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CLAIMS

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[Claim(s)]

[Claim 1] The gate valve characterized by having made into the shape of a taper the valve seat prepared in the periphery of the substrate conveyance mouth of a sealed cabin, and enabling the attitude of the valve element which can be stuck to this valve seat in the direction which crosses to a substrate conveyance side with the actuator for opening and closing.

[Claim 2] The gate valve of the claim 1 which two or more sealed cabins adjoin and are prepared, and each conveyance mouth of the aforementioned sealed cabin carries out phase confrontation, and at least one of the valve seats formed in this conveyance mouth periphery is a taper side, and prepares in one the valve element which opens and closes two or more aforementioned conveyance mouths and by which one actuator was formed in this valve element.

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[Translation done.]

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